# Australian Curriculum linked lessons

# *Fluency*

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It is very easy to fall into the impression that the proficiency strand Fluency is all about knowing your basic number facts in all its many and splendid ways. Indeed knowing 'stuff' like your multiplication facts is incredibly handy. What is easy to overlook, however, is that within Fluency there are also requirements that are based in Algebra (continue and create patterns etc.); Measurement and Geometry (compare lengths of objects, name the days of the week, choose appropriate units of measurement for calculation of perimeter and area, etc.); and Statistics and Probability (use the language of chance to describe outcomes, collect and record data, etc.) (ACARA, 2014). However, the one that I think that can really get lost and ignored is estimation.

According to the New Zealand Council for Educational Research (NZCER, 2007) website (I think this is a fabulous resource and well worth visiting), there are three situations when it is appropriate to use estimation:

- When an exact answer is not needed and an estimate is good enough; for example: "Do I have enough money to buy this?"
- When there is not enough information to get an exact answer; for example: "About how many times will my heart beat in an hour?
- When you want to check if the answer from a calculation is sensible one.

Although computational estimation is probably the most practised of all estimation, it has been my experience that perhaps even this is not exercised enough. It is easy sometimes to forget to make it an integral part of the lesson. I would like to suggest that computational estimation should be employed as part of the routine for solving all problems: that is, before students can apply themselves to finding an exact solution, they must provide an estimation.

It seems that some students do not feel that they have strategies for estimation. Couple this with the belief that in mathematics 'not to be totally correct is to be wrong', and they are not likely to employ this very useful tool. Providing students with opportunities to estimate in a non-threatening environment may assist in making them more inclined to use estimation strategies.

I would like to suggest some great activities which (in my experience) students find engaging. Both of these activities are documented in one of my favourite resources: Maths300 (Education Services Australia [ESA], 2010).

## Estimating angles

The activity below is used to tap into the power of using a kinaesthetic approach and although, at this stage, it is less about estimating angles than constructing angles, this is an important step.

Take the students outside with a number of ropes of different length. A pole such as a netball post is good for demonstration purposes. Tie two ropes to the pole. These ropes become the line segments. Ask two students to take a rope each and stretch them out along the same line. Get one of the students to walk completely around the pole keeping their line stretched until they

arrive back at the original position to show how a circle can be described. For the most part, because many of the students ride bikes, scooters and 'rip sticks', they have an informal understanding that a complete circle is called a 360. Through conversation it can be formalised that the 360 refers to 360 degrees.

The students then move off in pairs or threes (if no pole is available, the third person can become the pivot point). Get the students to do lots of work in showing their understanding of the different types of angles and ask them to describe some angles through estimating the size. This is a good activity in that it gives a sense that angles are a measure of turn. After consolidating understanding about angles, ICT can be employed to provide the opportunity for students to estimate the size of many and varied angles.
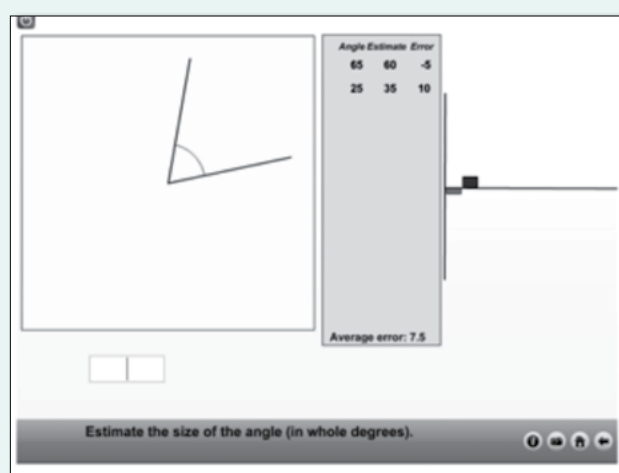


Figure 1. Angle Estimation.

*Angle Estimation* (ESA, 2014) is a terrific piece of software. There are really two elements to it: where an angle is given and a student has to estimate how big the angle is (Figure 1); and where the student is given the size of the angle and has to use the cursor to draw a prescribed angle (Figure 2). The feedback generated from both of these activities gives an indication of how close their estimation is. At first, the students are often way out in their estimations as, for many, it is less about reasoning and more about 'just having a play'. After a short while, the students start to be more strategic, and from the conversations I have had with them and from what I have overheard, it seems that many start to 'benchmark' the size of the angles to develop their estimations. That is, they work out where some key angles are (90°, 180°, 270° and 45° tend to be prevalent) and then work around and between

those bench-marks ("47° is a little bit bigger than 45°"or "65° is about half way between 45° and 90°"). It does not seem to take long before the estimations start to become much more refined and the accuracy starts to improve.

Another strategy which some students employ is to use an angle they know well and then visualise iterations of that measurement. One student described that she had a really good 'picture' of what 45° looked like and that she had worked out that half of that angle was about 22° and, if it was needed, then half of that again was 11°. Her argument was that by visualising combinations of these three angles she could get very close to working out any angle.
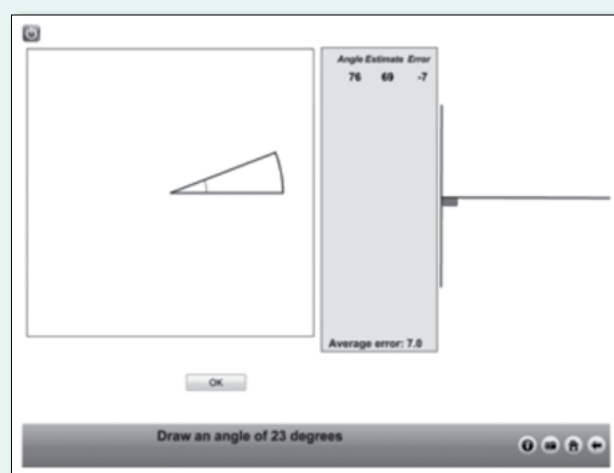


Figure 2. Draw an angle.

## Fraction Estimation

As a teacher, it is not long until you come to the realisation that even if a student has developed a sense of whole numbers, this does not always transfer to a sense of fractions. One of the reasons for this is the variety of representations used to express fractions.

*Fraction Estimation* is another piece of software from the Maths300 (ESA, 2010) collection. As with all virtual representations, there is a lot of basic work that needs attention through the use of manipulative materials before the students engage with this. Once they are ready, then *Fraction Estimation* can be of great benefit to them.

In *Fraction Estimation*, the student gets a choice of the representations with which they would like to start: Fraction Strips, Fraction Towers, Fraction Pies, Fraction Number, Percentage Area, Decimal Area, Percentage Number or Decimal Number.
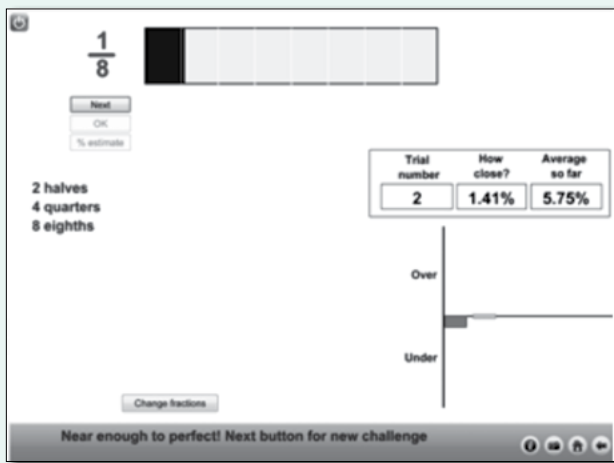
Figure 3. Fraction Estimation.

Fraction Strips involves dragging the cursor to display the required fraction (Figure 3). The fractions that are available to the students can be manipulated so that a student may only be dealing with very familiar fractions (perhaps quarters, halves and eighths) or with fractions which may challenge their thinking (fifths and ninths). Similar actions are required to indicate common fractions presented in a tower or a circle (pie) and when given a percentage to be represented on a variety of area models.

In the activity Fraction Number, students are required to give a numerical estimation to a given fraction. This is a repeated with Percentage Number and Decimal Number. Once again, one of the many strengths of this lies in the use of multiple representations of fractions in its various forms.

There is no doubt that fluency is important to develop. There is also no doubt that fluency is more than just remembering multiplication facts. To be fluent gives a student confidence, and confidence – well placed confidence, not the confidence that comes from 'not knowing what you do not know' – is a big help towards achieving success. I firmly believe that one area of fluency that we can better exercise to improve confidence is estimation. In fact, estimation should not be underestimated.

## References

New Zealand Council for Educational Research [NZCER]. (2007). *Computational estimation information: A framework for teachers.* Accessed from http://arb.nzcer.org.nz/support-materials/maths/concept_map_estimation.php

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